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Agricultural Memorandum No 480

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A tentative map showing the yield of grain maize in Britain

Ag. Memo 457 by C V Smith attempts to distinguish the areas in Eastern Region A.D.A.S. suitable for the economic production of grain maize. This note is an attempt to produce a grain yield map for southern England.

Yield - Weather Relationship

Gross photosynthesis was estimated by Monteith's Method for fully sunlit leaves (for Method see Ag. Memo. 386) during each month in the maize growing season at Wytham, Oxford. Photosynthesis was expressed as gm. per square metre land area per day divided by the area of sunlit leaves, and this was correlated with grain yield in cwt. per acre at 15% moisture content. Yield data for 1959 were excluded due to the dry weather. The best correlation (+ 0.82) was for July with regression

$$Y = 4.43P + 0.32$$

Y is yield in cwt. per acre at 15% moisture
P is photosynthesis in gm. per square metre land area per day per unit leaf area

This high correlation with pre-flowering photosynthesis may be associated with storage in the stem, since these reserves have been shown to be important later on during earing when they are transferred to the cob.

The value of P is expressed in terms of daily totals of total solar radiation and the mean daylight air temperature. The regression then allows yield to be associated with radiation and temperature.

In order to find the best areas for grain yield, climatic data on radiation and daylight temperature are required. The mean monthly radiation map for July given by Day (Met. Mag Vol 90 No. 1071) was used together with an estimated standard deviation for July radiation over southern England equal to 65 mw hrs/ cm^2/day.

The mean daylight air temperature was obtained from maps of averages of monthly maximum temperature and daily temperature range by using the formula (Ag. Mem. 16).

$$T = M - 0.4R$$

T is the mean daylight air temperature
M is the mean maximum air temperature
R is the mean daily air temperature range

The map of mean daylight temperature is figure 1. The temperature variation across southern England is less than 2°C and coastal districts are cooler than inland except for the Thames estuary. All the maximum temperature data refer to the period 1931/60, and approximately 0.5°C should be subtracted to give a better representation of the more recent climate. The standard deviation of

temperature over S. England was taken as 1.2°C.

Construction of the Map

A value of yield was chosen (40, 42,5, 45 or 47,5 cwt/acre) together with an isotherm from the mean temperature map. The temperature which is exceeded by approximately 90% of Julys was obtained as

(Mean temperature) - 1.3 (standard deviation of temperature)

This assumes that monthly mean temperatures are normally distributed. From this temperature and the yield value, the quantity of radiation required can be found. To this radiation value is added 1.3 (standard deviation for radiation), to give a derived mean radiation value. The places in S. England where the mean temperature and the derived mean radiation value coincide are marked with the expected yield. This process is repeated to build up the map.

The Map

Four zones are shown where the yield exceeds the stated value for 9 years in 10. Since the yield - weather relation is based on plot trial results under good management actual farm yields are likely to be less than those indicated. The map should therefore be used to indicate the most favourable areas and the relative yields in the different areas.

The highest yielding areas are the extreme S.E. of Essex and the northern part of Kent. Other good areas include the remainder of Essex, Suffolk, S.E. Cambridge and a small area of Hampshire and the Isle of Wight.

The low yielding part of the area which should mature grain to 40% dry matter lies in Berkshire and around Exeter. The western areas in Somerset and Gloucester are also relatively low yielding.

Any comments or criticisms should be sent direct to the author.

July 1972

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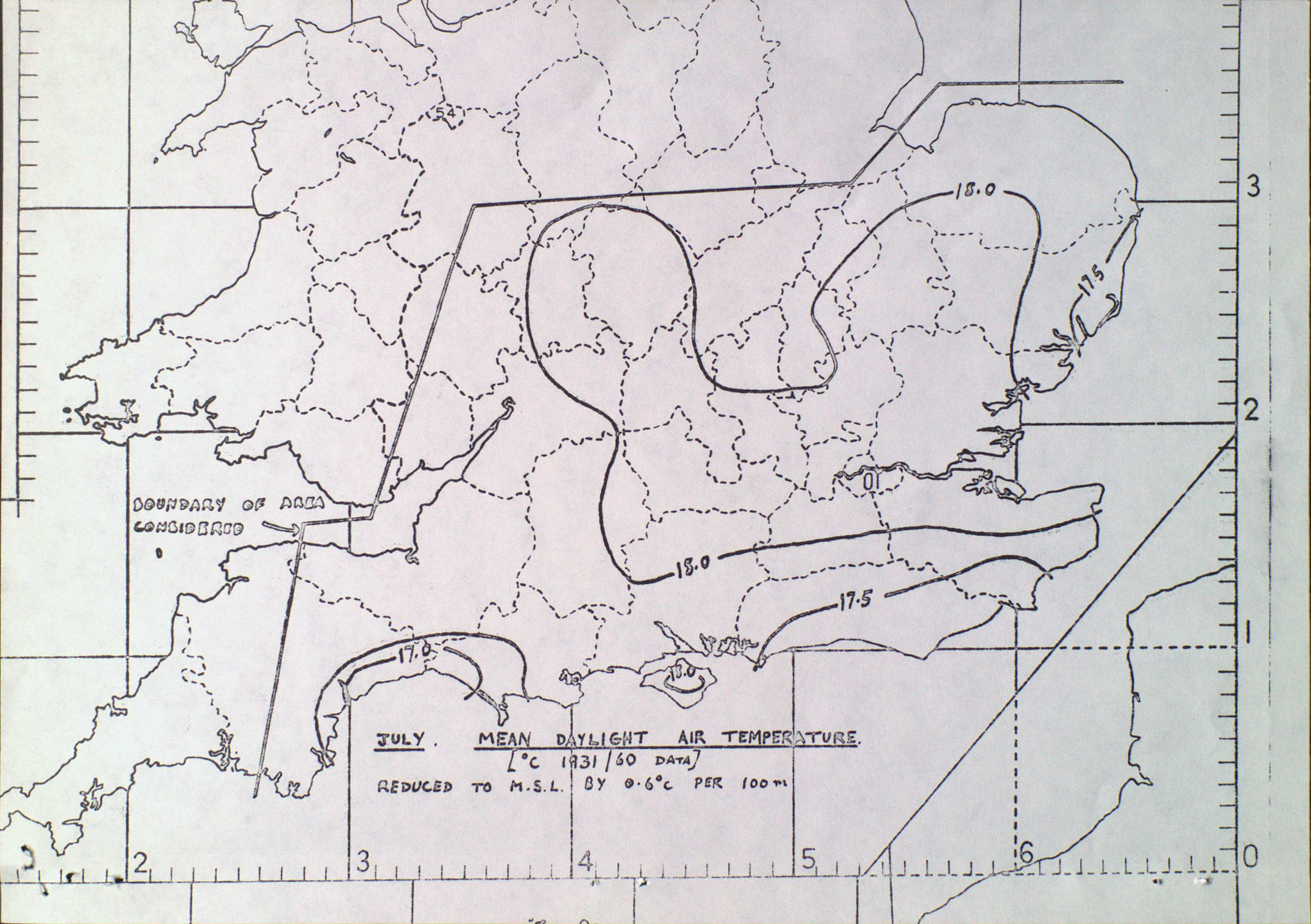
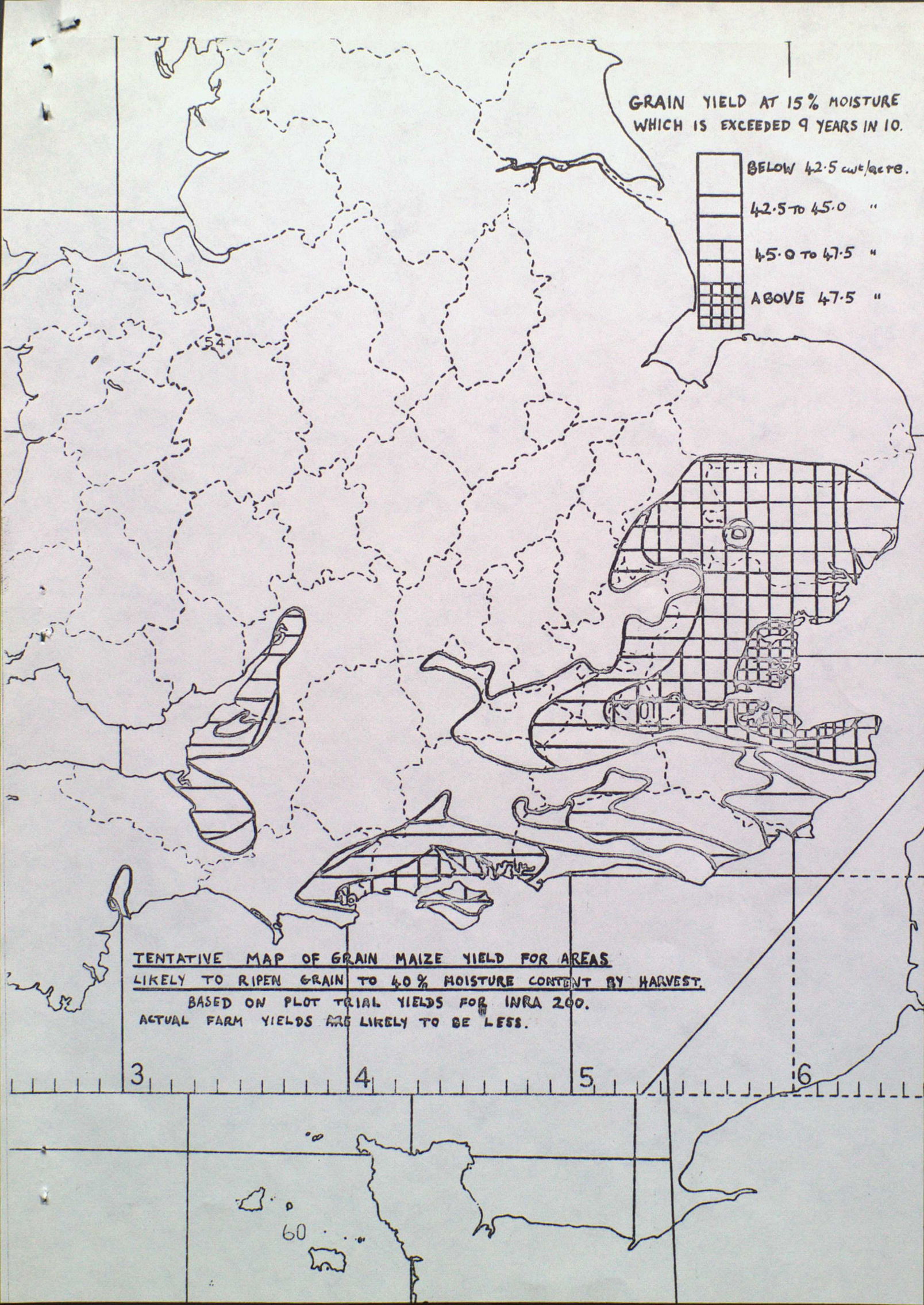
/LBN/7/72/70


54
18.0
17.5
01
BOUNDARY OF AREA CONSIDERED
18.0
17.5
17.0
18.0
JULY. MEAN DAYLIGHT AIR TEMPERATURE.
[°C 1931/60 DATA]
REDUCED TO M.S.L. BY 0·6°C PER 100m
3
2
1
0
2
3
4
5
6



TENTATIVE MAP OF GRAIN MAIZE YIELD FOR AREAS
LIKELY TO RIPEN GRAIN TO 40% MOISTURE CONTENT BY HARVEST.
BASED ON PLOT TRIAL YIELDS FOR INRA 200.
ACTUAL FARM YIELDS ARE LIKELY TO BE LESS.